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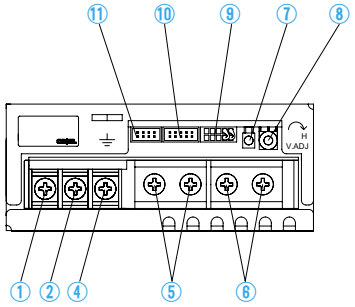
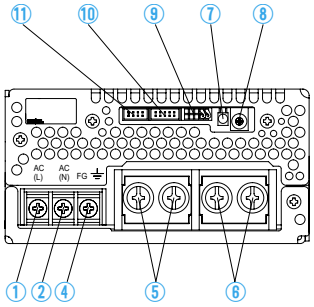
1 Terminal Block

∗ This content describes PBA300F - 1500F.
Please see External view about PBA50F - 150F.

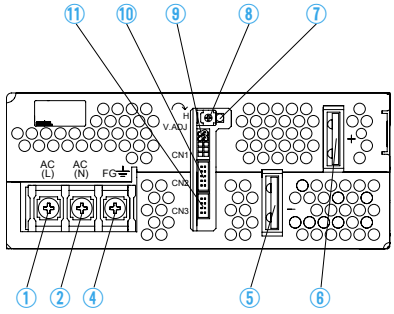
● PBA300F



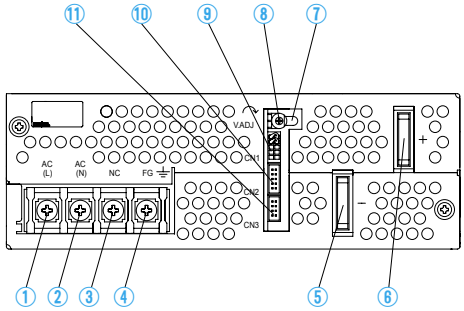
● PBA600F



● PBA1000F



● PBA1500F



①AC (L)
②AC (N)
③N.C.
④Frame Ground
⑤-Output
⑥+Output
⑦LED
⑧Output voltage adjustable potentiometer
⑨CN1
⑩CN2 } Connector for functions
⑪CN3

Pin connection and function of CN1

Pin No.	Function	
1	+M	: +Output voltage monitoring
2	+S	: +Remote sensing
3	-M	: -Output voltage monitoring
4	-S	: -Remote sensing
5	VB	: Voltage balance
6	CB	: Current balance
7	TRM	: Adjustment of output voltage
8	-S	: -Remote sensing
9	RC2	: Remote ON / OFF
10	RCG	: Remote ON / OFF ground

Pin connection and function of CN2

Pin No.	Function	
1	+M	: +Output voltage monitoring
2	+S	: +Remote sensing
3	-M	: -Output voltage monitoring
4	-S	: -Remote sensing
5	VB	: Voltage balance
6	CB	: Current balance
7	TRM	: Adjustment of output voltage
8	-S	: -Remote sensing
9	RC2	: Remote ON / OFF
10	RCG	: Remote ON / OFF ground

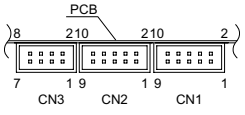
Pin connection and function of CN3

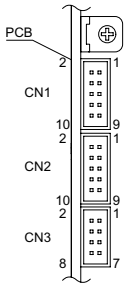
Pin No.	Function	
1	-S	: -Remote sensing
2	-S	: -Remote sensing
3	AUX	: Auxiliary output (12V 0.1A)
4	RC1	: Remote ON / OFF
5	AUXG	: AUX ground
6	N.C.	: No connection
7	PG	: Power good signal
8	PGG	: Power good ground

∗ The common signs in CN1, CN2 and CN3 as -S are same potential.

Mating connector and terminal of CN1, CN2 and CN3

Connector		Mating Connector	Terminal	Mfr.
CN1 CN2	S10B-PHDSS	PHDR-10VS	Reel : SPHD-002T-P0.5 Loose : BPHD-001T-P0.5	J.S.T
CN3	S8B-PHDSS	PHDR-8VS		





● PBA300F/600F ● PBA1000F / 1500F
The pin No. of CN1 to CN3

2 Function

2.1 Input voltage range

■The range is from AC85 - 264V or DC(Refer to SPECIFICATIONS).
Only AC input is available to comply with agency approval.
■A low input potential can correspond more than AC85V and DC120V by the option (Refer to 7 Option).
The decrease of load factor is needed, and consult us detailed.
■If the wrong input is applied, the unit will not operate properly and / or may be damaged. Avoid the followings to cause failure of the unit to apply square wave form input voltage, which is commonly used in UPS and inverters.

2.2 Inrush current limiting

■Inrush current limiting is built-in.
■If a switch on the input side is installed, it has to be the one handling the input inrush current.

● PBA50F, 75F, 100F, 150F

■The thermistor is used for protection from inrush current. When power is turned ON / OFF repeatedly within a short period of time, it is necessary to have enough time for power supply to cool down.

● PBA300F, 600F, 1000F, 1500F

■The thyristor technique is used for protection from inrush current.
If power is turned ON / OFF repeatedly within a short period of time, that may cause failure. It is necessary to have enough time between power ON and OFF.
■When the switch of the input is turned on, the primary inrush current and secondary inrush current are generated.

2.3 Overcurrent protection

■Overcurrent protection is built-in and activated at 105% of the rated current or 101% of the peak current.
Overcurrent protection protects the unit from short circuit and overcurrent condition. The unit automatically recovers when the fault condition is removed.
■If the output voltage drops more than 50% of the rated voltage in an overcurrent protection mode, the average current will also be reduced by the intermittent operation.

● PBA1000F, 1500F

■The output voltage is shut down when the overcurrent protection circuit operates continuously for 5 sec in PBA1000F, PBA1500F.
The minimum interval of AC recycling for recovery is 3 minutes. The recovery time varies depending on input voltage and load condition.

2.4 Overvoltage protection

● PBA50F, 75F, 100F, 150F, 300F

■The overvoltage protection circuit is built-in. The AC input should be shut down if overvoltage protection is in operation. The minimum interval of AC recycling for recovery is 3 minutes.
＊The recovery time varies depending on input voltage.

● PBA600F, 1000F, 1500F

■Overvoltage protection circuit to follow to output voltage is built-in. The AC input should be shut down if overvoltage protection is activated. The minimum interval of AC recycling for recovery is more than 3 minutes. The recovery time varies depending on input voltage.
＊Overvoltage protection circuit to follow to output voltage is not built into PBA300F. It corresponds by the option. Please consult us detailed.

Remarks :
Please avoid applying the over-rated voltage to the output terminal. Power supply may operate incorrectly or fail. In case of operating a motor etc. , please install an external diode on the output terminal to protect the unit.

2.5 Thermal protection

● PBA300F, 600F, 1000F, 1500F

■Thermal protection circuit is built-in and shut down under following condition.
①When the current and the temperature which exceed from the derating curve.
②The case FAN stops or air flow is interrupted and the amount of the wind decreases.
After cut off input voltage and cooling down inside of power supply, turns on the input of the power supply again.

2.6 Output voltage adjustment

■Output voltage is increased by turning potentiometer clockwise and is decreased by turning potentiometer counterclockwise.

● PBA50F, 75F, 100F, 150F

■A built-in potentiometer is lost, and there is an option : -V to be able to do a changeable output voltage in the potentiometer put on the outside (Refer to 7 Option).

● PBA300F, 600F, 1000F, 1500F

■The external output voltage control function is provided.
Adjustment of output voltage is possible in 110% from almost 0V of the rated output voltage by following.
・Applying the voltage externally
between TRM and -S on CN1 or CN2

■The output voltage level is able to calculated by ①.
However external voltage should not be less than -0.7V and more than 3.0V.

$$\text{Output voltage} = \frac{\text{The voltage between TRM and -S}}{2.5\ [\text{V}]} \times \text{rated output voltage} \cdots ①$$

The output voltage decrease when sourcing current from TRM.

■When the output voltage is decreased to about 0V, the fans may stop,ripple may increase and the PG signal may turn to be "High".

2.7 Remote ON / OFF

● PBA50F, 75F, 100F, 150F

■Option "-R" is available for remote ON / OFF (Refer to 7 Option).

● PBA300F, 600F, 1000F, 1500F

■Remote ON / OFF control becomes available by applying voltage in CN1. Remote ON / OFF circuit (RC2, RCG) is isolated from input, output, FG and AUX.
Table 2.1 shows the specification of remote ON / OFF.
Fig.2.1 shows the example to connect remote ON / OFF control, and followings are notes when you use the remote control.

①The output stops when the current is sank in RC2.
②The current sinking RC2 is 5mA typ and less than 12mA max.
③Built-in fans stop if the output is turned off with remote ON / OFF circuit.
The fans of PBA300F become low speed when the output voltage is turned off with remote ON / OFF circuit.
④The PG signal is turns to be "High" when the output voltage is turned off with remote ON / OFF.
⑤In parallel operation and several use, please note a necessary voltage and current because the content of Table 2.1 description is a value at only one use.
⑥When the voltage or the current other than showing in Table 2.1 between RC2-RCG are applied, the output voltage might not be normally output.

Table 2.1 Specifications of remote ON / OFF

Connection method		Fig.2.1 (a)	Fig.2.1 (b)	Fig.2.2 (c)
SW Logic	Output on	SW open (0.1mA max)	SW open (0.1mA max)	SW close (0.5V min)
	Output off	SW close (3mA min)	SW close (3mA min)	SW open (0.1mA max)
pin		RCG	AUXG	RCG, AUXG

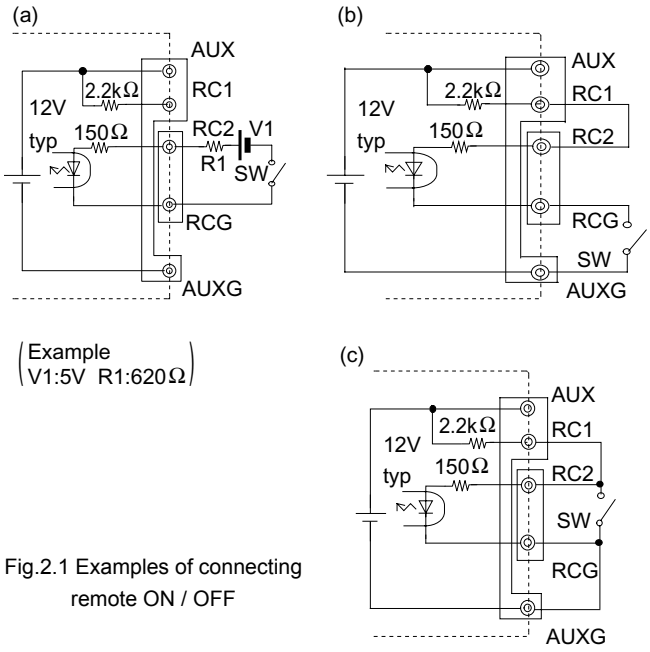


Fig.2.1 Examples of connecting remote ON / OFF

2.8 Remote sensing

(It is not in PBA50F and PBA75F.)

● PBA100F, 150F

■It corresponds by the option : -K. The correspondence model is -3R3 and -5. Please refer to 7 Option.

● PBA300F, 600F, 1000F, 1500F

■Remote sensing circuit is built-in.
Wiring method without using remote sensing is shown in Fig.2.2.
When you do not use the remote sensing, connect between +S and +M and between -S and -M with CN1.
When the power supply is shipped from a factory, a special harness (H-SN-19) is mounted on CN1.

■Wiring method with remote sensing is shown in Fig.2.3.
When you use the remote sensing, follow instruction as below.

①Note connecting wires enough because the load current flows to sensing line and an internal circuit of power supply is damaged occasionally, when defective contact of the screw such as loosening happens in the load line.
②Confirm line drop should be at 0.3V or less using a thick wire from the power supply to the load.
③Do not draw the output current from ±M at CN2.
④When remote sensing is used, output voltage might become unstable because of a impedance of wiring and load condition.
And the power supply should be evaluated enough.
Following are examples to improve it.
・-S sensing wire is removed and terminals between -M and -S are shorted.
・C1, R1 and R2 are connected as below figure.
Please ask details to us.

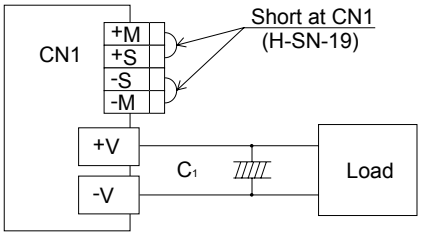


Fig.2.2 When not using remote sensing function

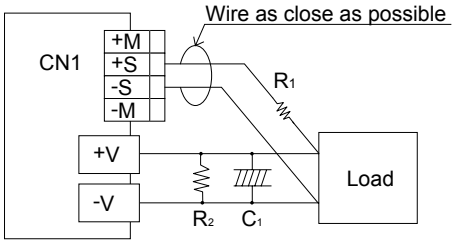


Fig.2.3 When using remote sensing function

2.9 Alarm

● PBA300F, 600F, 1000F, 1500F

■Table 2.2 shows the alarm function built-in the power supply. Please note that the alarm signal might take several seconds and be output.

Table 2.2 Explanation of alarm

Alarm		Output of alarm
PG	The PG signal is "Low" when the power supply operates correctly. The signal turns to be "High" when the fan stops or the power supply stops.	Open collector method Good: Low (0.5V max at 10mA) Bad : High or Open 50V 10mA max

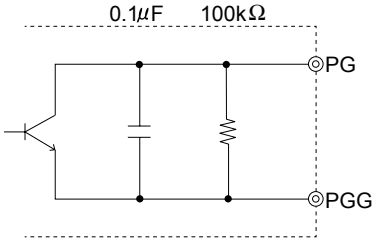


Fig.2.4 Internal circuit of PG

■Notes when you use PG signal are shown below.

①The PG signal turns to be "High" when the output voltage is turned off with remote ON / OFF.

②The PG signal may turn to be "High" when the output current becomes 10% or less of the ratings current in parallel operation. Then, the fans, too, stop.

③The PG signal may turn to be "High" when the output voltage is varied to about 0V and varied rapidly by external adjustment at few output current.

■The PG signal circuit (PG, PGG) is isolated from input, output, FG, RC and AUX.

3 Peak Current

● PBA300F-24, PBA600F-24, PBA1000F-24, PBA1500F-24 / 36 (There is not setting in other models.)

■Peak current can output by the following conditions.

- AC170 - 264V
- t1≦10 [sec]
- Ip≦Rated peak current
- Iave≦Rated current
- Duty= $\frac{t1}{t1+t2} \times 100$ [%] ≦35%

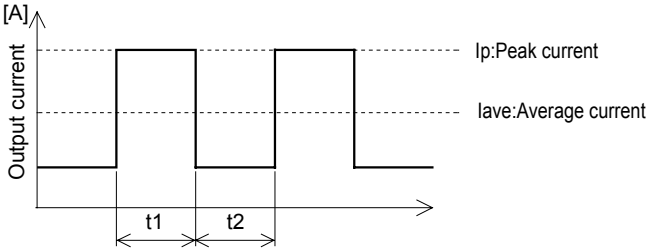


Fig.3.1 Peak current

4 Series / Parallel Operation

4.1 Series operation

■Series operation is possible by connecting as shown in Fig.4.1. Output current in series connection should be lower than the lowest rated current in each unit.

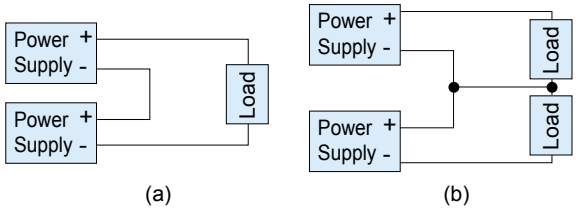


Fig.4.1 Examples of connecting in series operation

4.2 Parallel operation / Master-slave operation

● PBA50F, 75F, 100F, 150F

■Parallel redundancy operation is available by connecting the units as shown below.

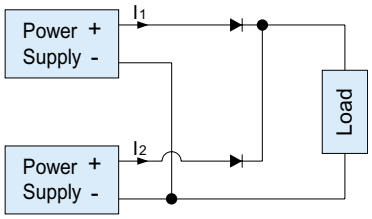


Fig.4.2 Example of connecting in parallel operation

Remarks :

This product is not good at parallel operation by which the OR diode is not put because the synchronous rectification method is used.

■Values of I_1 and I_2 become unbalanced by a slight difference of the output voltage. Make sure that the output voltage of units is of equal value and the output current from each power supply does not exceed the rated current.

$I_1, I_2 \leqq$ the rated current value

● PBA300F, 600F, 1000F, 1500F

■Parallel operation is available by connecting the units as shown in Fig.4.3.

±S, VB and CB are connected mutually in parallel, and ±S and ±M are connected with CN1 of the master power supply.

When the power supply is shipped out of a factory, special harness (H-SN-19) mounts on CN1 of each power supply.

Remove special harness (H-SN-19) mounted on CN1 of the slave power supply. Please use optional harnes : H-PA-3 to connect ±S, VB and CB in parallel.

As variance of output current drew from each power supply is maximum 10%, the total output current must not exceed the value determined by the following equation.

(Output current at parallel operation)
= (the rated current per unit) × (number of unit) ×0.9

■When the number of units in parallel operation increases, input current increases at the same time.

Adequate wiring design for input circuitry is required, such as circuit pattern, wiring and current capacity for equipment.

■In parallel operation, the maximum operative number of units is 5.

■Please consult us the harness for a parallel operation.

■The wiring impedance of the load from each power supply must become even so that the output current balance circuit may operate normally.

■Output voltage in parallel operation is adjustable by using the potentiometer of the "master" unit. Select one power supply to be the master, and turn the potentiometer of the other, slave power supplies, clockwise to the end.

Then use the potentiometer of the mater to adjust output voltage.

■When remote sensing is used in parallel operation, the sensing wire must be connected only to master.

Terminals +S and -S of slave power supplies must be connected to master.

■It is impossible parallel operation with the other model.

■The output voltage changes by about 5% in a parallel operation when one stops by the fail of input side.

■When the output current becomes less than 10% of the rated current, the PG signal may become High and the fans may stop.

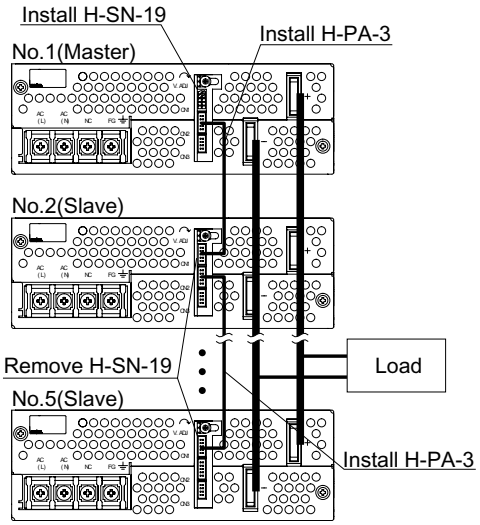


Fig.4.3 Examples of connecting parallel operation
(The case of PBA1500F)

4.3 Parallel redundancy operation

● PBA300F, 600F, 1000F, 1500F

■N+1 redundancy is possible for reliability.

■The system can be operated in a normal power supply even if one of power supplies breaks down when using in parallel by power supply number +1 necessary for the system.

■Consult us about parallel redundancy.

5 Assembling and Installation Method

5.1 Installation method

■The screw should be inserted up to 6mm max from outside of the power supply to keep a distance between inside parts and an isolation.

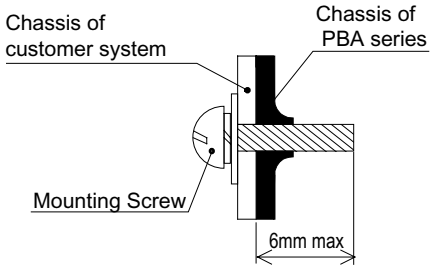


Fig.5.1 Mounting screw

● PBA50F, 75F, 100F, 150F

■When two or more power supplies are used by side, position them with proper intervals to allow enough air ventilation. Ambient temperature around each power supply should not exceed the temperature range shown in derating curve.

● PBA300F, 600F, 1000F, 1500F

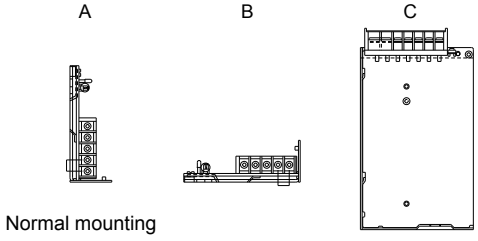
■Fans for forced cooling are built-in.
Do not block the ventilation at suction side (terminal block side) and its opposite side.
Fix firmly, considering weight, though it can be used by the installation.

■Install the air filter so that the effect of cooling by the fan does not decrease when the power supply is used in a dusty place.

5.2 Derating

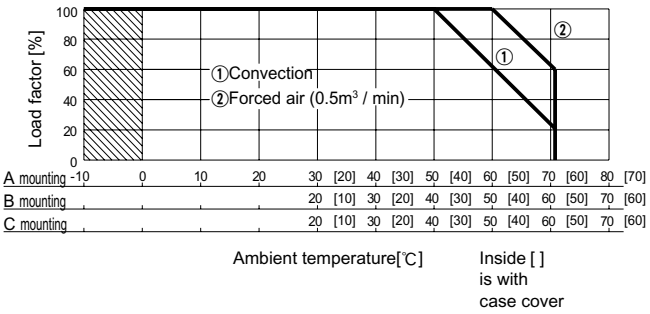
● PBA50F, 75F, 100F, 150F

(1)Mounting method



Normal mounting

(2)Derating curve


Load factor [%]
100
80
60
40
20
0
①Convection
②Forced air (0.5m³ / min)
①
②
A mounting -10 0 10 20 30 [20] 40 [30] 50 [40] 60 [50] 70 [60] 80 [70]
B mounting 20 [10] 30 [20] 40 [30] 50 [40] 60 [50] 70 [60]
C mounting 20 [10] 30 [20] 40 [30] 50 [40] 60 [50] 70 [60]
Ambient temperature[℃]
Inside [ ] is with case cover

■Specifications inside the hatched area, Ripple · Ripple Noise is changed.

■Standard of cooling
Please use do to become below the temperature which the temperature of Point A shows in Table 5. Point A is displayed on the chassis (Refer to External view).

Table 5

	Point A	
	Ambient temperature:50℃	Ambient temperature:71℃
PBA50F	72℃ or less	82℃ or less
PBA75F	83℃ or less	84℃ or less
PBA100F	87℃ or less	83℃ or less
PBA150F	89℃ or less	85℃ or less

● PBA300F, 600F, 1000F, 1500F

■Derating curve depending on ambient temperature is shown in Fig.5.2.
In the hatched area, the specifications of Ripple and Ripple Noise are different from other, refer to specifications.

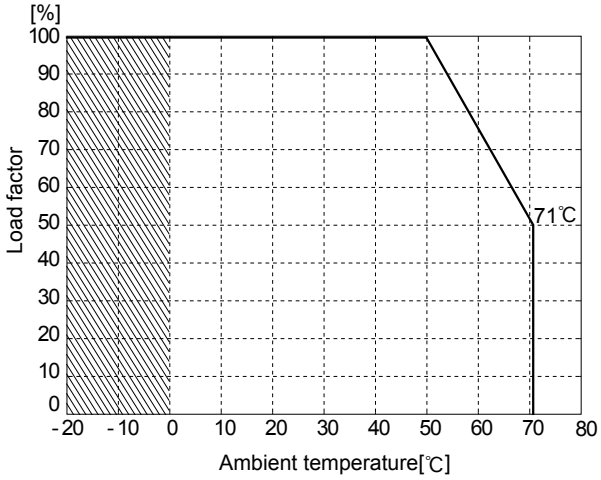


Fig.5.2 Derating curve depending on ambient temperature

■Derating curve depending on input voltage of PBA1500F is shown in Fig.5.3.

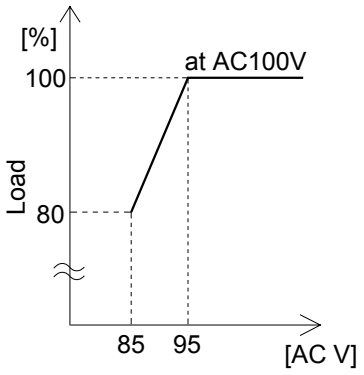


Fig.5.3 Derating curve depending on input voltage (PBA1500F)

5.3 Expectancy life and warranty

■Expectancy life

The expectancy life is as follows.

Installation condition	Average ambient temperature(year)	Load factor	
		50%	100%
PBA50F - 150F (Installation A)	Ta=30℃	More than 10 years	More than 10 years
	Ta=40℃	More than 10 years	6 years
	Ta=50℃	5 years	3 years
PBA300F - 1500F	Ta=40℃	7 years*	7 years*
	Ta=50℃	6 years*	5 years

*It is a value to which the maintenance of the fan is required.

● PBA300F, 600F, 1000F, 1500F

■Regular exchange is necessary for the fan, because the life expectancy (R (t) =90%) of the fan depending on the use condition is shown in Fig.5.4.

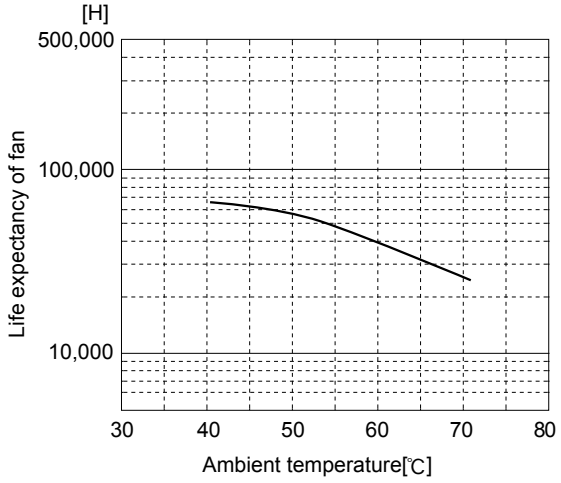


Fig.5.4 Life expectancy of fan

■Warranty

PBA50 - 150F :

The warranty is 5 years when average ambient temperature of year is Ta=40℃ or less and load factor is average 50% or less. However, the warranty is 3 years when average ambient temperature of year is Ta=50℃ or less and load factor is series 100%.

PBA300 - 1500F :

The warranty is 5 years if it is derating curve.

6 Others

6.1 Output current monitor

● PBA300F, 600F, 1000F, 1500F

■It is possible to know the output current to measure the voltage between CB to -S in CN1 or CN2.

■The relation between CB voltage and load current is shown in Fig.6.1.

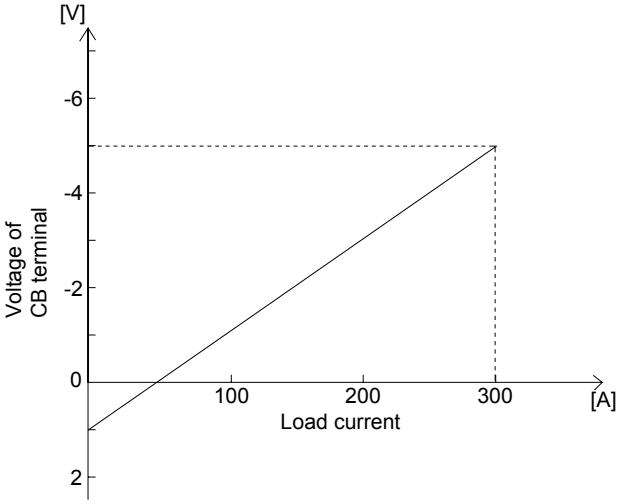


Fig.6.1 Load current conversion graph(PBA1500F-5)

Remarks :

Fig.6.1 is nominally, not guarantee.

Please ask to us if the characteristic of the other model is necessary.

■Note the following when you measure the voltage of CB terminal.

- Please note wiring so as not to malfunction because of the noise.
- Please use the input impedance of measurement equipment must be 500kΩ or more.
- Please note internal parts might be damaged when CB terminal and -S terminal are short circuit.

6.2 Isolation

■For a receiving inspection, such as Hi-Pot test, gradually increase (decrease) the voltage for start (shut down). Avoid using Hi-Pot tester with the timer because it may generate voltage a few times higher than the applied voltage, at ON / OFF of a timer.
If the unit is tested on the isolation between input & output and output & FG must be shorted output, RCG, PGG and AUXG.

6.3 Auxiliary power (AUX)

● PBA300F, 600F, 1000F, 1500F

■Auxiliary power (AUX : 12V0.1A) is possible for remote ON / OFF and its attached circuit from CN3.
■AUX circuit (AUX, AUXG) is isolated from input, output, FG, PG and RC.
■Please do not take out the current which exceeds 0.1A from AUX to avoid the breakdown of the power supply and the malfunction.
Do not exceed 0.1A on starting up when you connect the DC-DC converter with AUX.

6.4 External components (PBA1500F)

■This power supply complies with FCC Part15 class B and EN55022-B in connecting a noise filter with the external.

Example of value of external noise filter

L1 : 0.45mH L2 : 0.45mH
C1 : 0.1μF C2 : 0.1μF C3 : 0.1μF
C4 : 4700pF C5 : 4700pF
R1 : 2MΩ R2 : 2MΩ

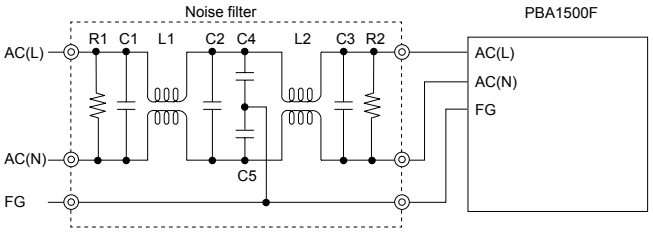


Fig.6.2 External noise filter
Recommendation noise filter : ZRAC2220-11 (TDK)

7 Option

7.1 Option outline

■Consult us detailed option and delivery before hand.
■It is possible a combination of the option, and consult us that it is not possible to do according to the option for the combination occasionally.

●-C
・-C means internal PCB is coated.
(Humidity improvement goods)

●-E, -G
・Low leakage current type.
・The difference from standard is shown Table 7.1.

Table 7.1 Low leakage type

	-E(PBA50F - 150F)	-G
Leakage current(AC240V)	0.5mA max	0.15mA max
Conducted Noise	Class A	Not available
Ripple Noise	1.5 times standard	2.0 times standard

●-U
・Operation stop voltage is set at a lower value than standard version.
PBA300F / 600F / 1000F / 1500F correspond by option : -U.
PBA50F / 75F / 100F / 150F correspond by standard.
Use condition
Output

PBA50F	15W	(10W)	PBA300F	125W	(83W)
PBA75F	35W	(20W)	PBA600F	250W	(165W)
PBA100F	50W	(30W)	PBA1000F	500W	(330W)
PBA150F	65W	(40W)	PBA1500F	750W	(495W)
				(	)3.3V Output

Input
AC50V (DC70V)
Duty 1s / 30s
* Avoid a continuous use for more than 1 second under the above-said conditions lest the power supply should be damaged.

●-F1 (PBA600F / 1000F / 1500F)
・Long-lived fan type (PBA300F is not set).
・The difference from standard is shown Fig.7.1.
・Externals change into PBA600F. Please refer to externals chart for details.

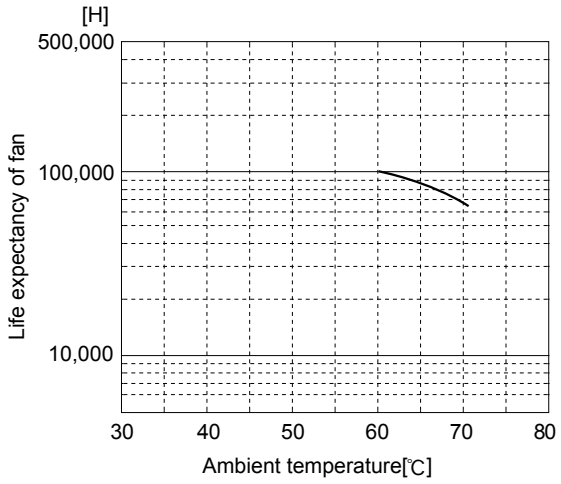


Fig.7.1 Life expectancy of long-lived fan

●-F3 (PBA300F / 600F / 1000F / 1500F)

・Reverse air exhaust type.
・The difference from standard is shown Fig.7.2 and Fig.7.3.

Fig.7.2 Air flow(-F3)

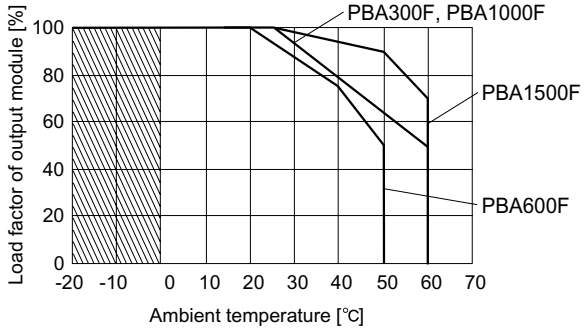


Fig.7.3 Derating curve depending on ambient temperature(-F3)

●-F4 (PBA300F / 600F / 1000F / 1500F)

・Low speed fan for reducing sound.
・The difference from standard is shown Fig.7.4.

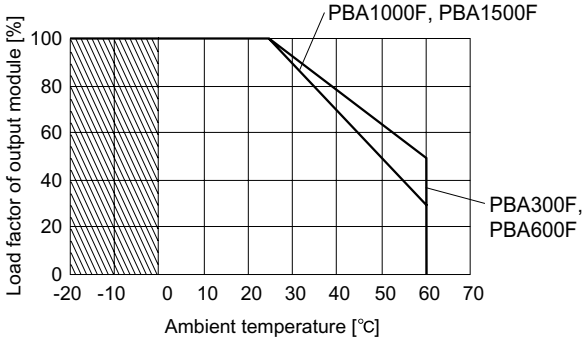


Fig.7.4 Derating curve depending on ambient temperature(-F4)

●-T (PBA50F / 75F / 100F / 150F)

・-T means terminal block is changed from horizontal to vertical position.
・Consult us external view in details.

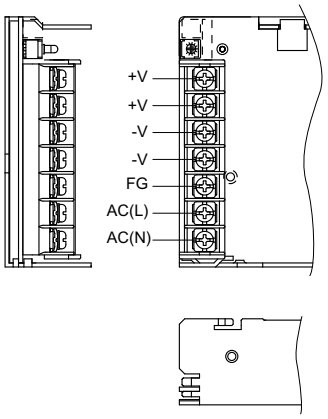


Fig.7.5 Example of option -T (PBA100F)

●-J (PBA50F / 75F / 100F / 150F)

・-J means terminal block is changed to connector.
・Special harness is prepared. Refer to option parts.
・Consult us external view in details.
・PBA100F / 150F corresponds to -12, -15, -24, -36 and -48 models.

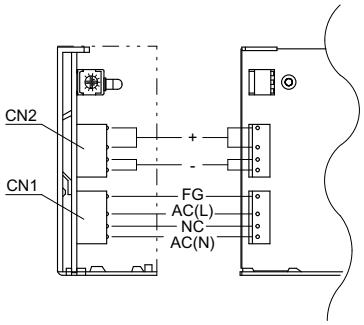


Fig.7.6 Image of option -J

I / O Connector		Mating Connector	Terminal
CN1	5289-4A	5199-04	Chain : 5194PBT
			Loose : 5194PBTL
CN2	5277-4A (PBA50F)	5196-04 (PBA50F)	Chain : 5194PBT
			Loose : 5194PBTL
	5277-6A (PBA50/100/150F)	5196-06 (PBA75/100/150F)	Chain : 5194PBT
			Loose : 5194PBTL

✻Maximum 5A per pin of CN2 can be applied (Mfr. Molex)

●-R (PBA50F / 75F / 100F / 150F)

■Option "-R" is available for remote ON / OFF.

Between RC (+) and RC (-)	Output
SW ON (4.5 - 12.5V)	ON
SW OFF (0 - 0.5V)	OFF

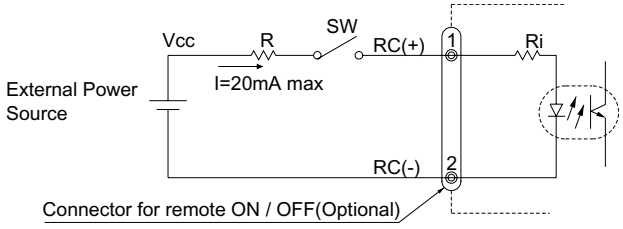


Fig.7.7 Example of using remote ON / OFF

■When external power source is in the range of 4.5 - 12.5V, current limit resistance R is not requierd. However, when external power source exceeds 12.5V, current limit resistance R must be connected.

To calculate the current limit resistance use following equation :

$$R[\Omega]=\frac{Vcc-(1.1+Ri\times 0.005)}{0.005}$$

Where ;
Vcc=External Power Source
Ri=The internal resistance (780Ω)

■A wrong connection may damage the internal components of the unit.

■Remote ON / OFF circuit (RC (+), RC (-)) is isolated from input, output and FG.

●-N (PBA50F / 75F / 100F / 150F)

- With case cover.
- External size is changed and refer to External view.
- Derating curve changes from the standard (Refer to 5.2).
- Only -24 model is applying for the UL508 standard.

●-N1

- -N1 means DIN rail attachment is attached to standard model.
- Consult us external view in details.
- -N1 becomes a type with case cover.

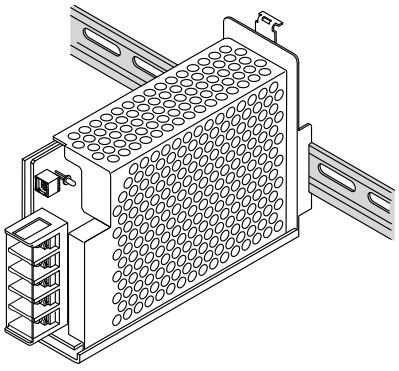


Fig.7.8 Image of installation option -N1

●-V (PBA50F / 75F / 100F / 150F)

- A built-in potentiometer is lost, and connector which can be connected with outside potentiometer is installed.
- Consult us external view in details.
- Please note that the output voltage becomes unstable when CN5 is energized while opened.

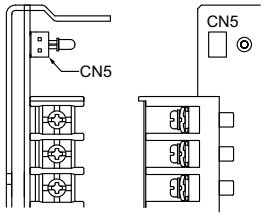


Fig.7.8 Upper view of option -V

●-K (PBA100F / 150F / only -3R3 / -5)

- Remote sensing function can be used for option "-K".
- Please note the correspondence model.
- Consult us details.